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FISCHER, P. H., DUVAL, M. & RAFFY, A. 1933. Études sur les échanges respiratoires des littorines. *Archives de zoologie expérimentale et générale* **74** (33): 627–634.

KOHN, A. J. 1960a. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Annals and Magazine of Natural History* (13) **2** (17): 309–320.

KOHN, A. J. 1960b. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bulletin of the Bingham Oceanographic Collection, Yale University* **17** (4): 1–51.

THEILE, J. 1910. Mollusca. B. Polyplacophora, Gastropoda marina, Bivalvia. In: SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika ausgeführt in den Jahren 1903–1905* **4** (15). *Denkschriften der medizinisch-naturwissenschaftlichen Gesellschaft zu Jena* **16**: 269–270.

(continued inside back cover)

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ANNALE VAN DIE SUID-AFRIKAANSE MUSEUM

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A NEW *REDIVIVA* BEE
(HYMENOPTERA, MELITTIDAE)
FROM THE NORTH-WESTERN CAPE PROVINCE,
SOUTH AFRICA

By
V. B. WHITEHEAD
&
K. E. STEINER

Cape Town

Kaapstad

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A NEW *REDIVIVA* BEE (HYMENOPTERA, MELITTIDAE)
FROM THE NORTH-WESTERN CAPE PROVINCE,
SOUTH AFRICA

By

V. B. WHITEHEAD

Entomology Department, South African Museum, Cape Town

&

K. E. STEINER

National Botanical Institute, Kirstenbosch, Claremont

(With 5 figures and 1 table)

[MS accepted 21 September 1993]

ABSTRACT

A new oil-collecting bee, the smallest in the winter rainfall region, is described. It is restricted to mountainous areas, from Clanwilliam to Springbok. Females collect oil from *Hemimeris racemosa* and *Colpias mollis* (Scrophulariaceae) and are the only known pollinators of the latter. The species can be recognized by its small size, the presence of white hair bands on the apical margins of the metasomal terga and the shape of the genitalia and terminal sterna of the male.

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INTRODUCTION

For the past ten years we have been investigating the relationship between oil-collecting bees of the genus *Rediviva* and oil-secreting host plants in the Scrophulariaceae and Orchidaceae in southern Africa (Whitehead & Steiner 1985, 1992, 1993; Steiner & Whitehead 1990, 1991). In the arid areas of the western Cape, we have discovered several new species of *Rediviva*. One of the most distinctive of these, a small dark bee with prominent white banding on the abdomen, is described below.

METHODS

Details of the methods of preparation and measurement of the various body parts are given in Steiner & Whitehead (1990) and Whitehead & Steiner (1992). The location and structure of hairs specialized for oil-collecting were determined by sampling pubescence from several areas on the tarsi of the anterior and middle legs. These hairs were dehydrated in 96 per cent ethyl alcohol and mounted in Euparal. Illustrations were made using a drawing tube at a magnification of 125 times. Morphological terms follow Michener (1981), except for numbering of individual tarsal segments, which was necessary to characterize more precisely the location of the various forms of the oil-collecting hairs (Whitehead & Steiner 1993). Surface sculpturing terms used are those of Harris (1979).

DESCRIPTION

Rediviva albifasciata sp. nov.

Figs 1-5

Diagnosis

Rediviva albifasciata is the smallest of the oil-collecting bees in the winter rainfall region, with a body length of 8-10 mm in females and 7-8 mm in males. In addition, it is the only bee in this area that has white hair bands on the apical margins of metasomal terga 1-4. Forelegs of females are not attenuate and are approximately three-quarters the length of the body. The dorsally flattened apical half of the gonostylus, the shape of the apical and lateral lobes of S7 and the entire (not emarginate) apical margin of S8 in males, are additional characters that make this bee distinctive.

Rediviva albifasciata may be confused with the small form of *R. politissima* (Cockerell) of the eastern Cape, which also has white hair bands on the apical margin of the metasomal terga. However, the latter species can be distinguished by the smooth, shiny appearance of the metasomal terga, longer front legs of the female, and differences in genitalia and sterna 7-8 of males.

Type locality

Cape Province, 23 km south of Springbok, farm Mesklip, 2917DD.

Etymology

Albus and *fascia*, Latin for white and a band, referring to the prominent bands of white hairs on the apical margin of the metasomal terga.

Material examined

Type material. *Holotype*: SAM-HYMB000384, female, Cape Province, 23 km south of Springbok, farm Mesklip, 2917DD, K. E. Steiner, 10 Aug. 1985. *Allotype*: SAM-HYMB000385, male, Cape Province, Springbok, Hester

Malan Nature Reserve, 2917DB, M. Struck, 30 July 1986. *Paratypes* (64 ♀♀, 14 ♂♂)—*Cape Province*: 1 ♀, 6.2 km south of Clanwilliam, 3218BB, K. E. Steiner, 10 Sept. 1989; 1 ♀, 7 km south of Clanwilliam, 3218BB, K. E. Steiner, 3 Sept. 1986; 1 ♀, on N7 1 km north of Clanwilliam, 3218BB, K. E. Steiner, 20 Aug. 1988; 4 ♀♀, 18 km south of Ramskop Camp, Clanwilliam, 3218BB, V. B. Whitehead, 24 Aug. 1984; 5 ♀♀, 6.2 km south of Clanwilliam, on old road to Citrusdal, 3218BB, V. B. Whitehead, 10 Sept. 1984; 2 ♀♀, 6 km south of Ramskop Camp, Clanwilliam, 3218BB, V. B. Whitehead & M. MacPherson, 30 Aug. 1985; 3 ♀♀, 7 km south of Clanwilliam, 3218BB, V. B. Whitehead, 3 Sept. 1986; 1 ♀, 7.9 km east of Garagams, 3017BD, K. E. Steiner, 28 July 1985; 4 ♀♀, 7.9 km east of Garagams, 3017BD, K. E. Steiner, 10 Aug. 1985; 3 ♀♀, Kamieskroon, farm Bakleikraal, 3018AA, K. E. Steiner, 19 Aug. 1988; 5 ♀♀, 40 km north of Kamieskroon, 2917DD, V. B. Whitehead, 5 Sept. 1986; 1 ♀, Kamieskroon, 4.3 km north of turnoff to Leliefontein, 3018AA, V. B. Whitehead, 19 Aug. 1988; 3 ♀♀, 40 km north of Kamieskroon, 2917DD, V. B. Whitehead & M. MacPherson, 24 Aug. 1985; 3 ♀♀, 20 km east of Karkams, 3017BD, V. B. Whitehead, 10 Aug. 1985; 4 ♀♀, 8 km east of Karkams, 3017BD, V. B. Whitehead, 28 Aug. 1985; 3 ♀♀, 23 km south of Springbok, 2917DD, K. E. Steiner, 10 Aug. 1985; 1 ♀, 23 km east of Springbok, 2918CA, K. E. Steiner, 23 Aug. 1989; 2 ♀♀, 1 ♂, Hester Malan Reserve, Springbok, 2917DB, K. E. Steiner, 23 Aug. 1989; 1 ♂, Hester Malan Nature Reserve, 2917DB, M. Struck, 30 July 1986; 2 ♂♂, Hester Malan Nature Reserve, 2917DB, M. Struck, 2 Aug. 1986; 1 ♂, Springbok, Spektakel Pass, 2917DA, V. B. Whitehead, 9 Aug. 1985; 3 ♀♀, 20 km south of Springbok, 2917DD, V. B. Whitehead, 10 Aug. 1985; 5 ♀♀, 3 ♂♂, Hester Malan Reserve, Springbok, 2917DB, V. B. Whitehead, 12 Aug. 1986; 1 ♀, Messelpad at Buffels River, 2917DC, Springbok, V. B. Whitehead, 23 Aug. 1990; 2 ♂♂, farm Mesklip, Springbok, 2917DD, V. B. Whitehead, 4 Aug. 1992; 1 ♀, 3 ♂♂, 23 km south of Springbok, 2917DD, V. B. Whitehead, 24 July 1993; 5 ♀♀, Springbok, Goegap Reserve, 2917DB, V. B. Whitehead, 13 Aug. 1993; 3 ♀♀, Springbok, Goegap Reserve, 2917DB, V. B. Whitehead, 24 Aug. 1993.

Description

Female

Measurements and ratios. Holotype: body 8.8 mm, forewing 7.7 mm, head width 3.0 mm, head length 2.4 mm, interocular distance 2.0 mm, eye length 1.8 mm, and length to width ratio of malar space 0.29 mm. Other material: measurements and ratios of 30 specimens from entire distribution area are given in Table 1.

Integumental colour. Body black to dark brown; distal third of mandibles, apical margin of clypeus and metasomal terga 1–4 reddish-brown; tegula light brown; coxa, trochanter and femur on all legs dark brown, tibia and tarsus light brown; costa and stigma of forewing light brown, other veins dark brown; flagellum light brown on underside; pygideal plate dark brown to black, light brown at base.

Structure (Table 1). Head wider than long, inner eye margins converging strongly above and only slightly below (Fig. 1F); interocular distance greater

than eye length (2.9 : 1.8); head seen from front with ocelli on slightly raised area of vertex (Fig. 1F); inner distance between lateral ocelli greater than ocellular distance (26 : 18) and 4–5 times distance of lateral ocellus to occipital ridge. Antenna: length of first flagellomere less than half length of scape (9 : 20), greater than length of flagellomeres 2 and 3 together (9 : 8). Mouthparts: (Fig. 1A–G) glossa one-third length of prementum, not extending beyond second basal segment of labial palp, paraglossa reaching to a little beyond half length of glossa; labial palp about twice length of glossa (62 : 29), segments 2 and 3 expanded slightly distally (Fig. 1A); ligular arms occupying basal two-thirds of prementum; cardo slightly shorter than stipes (21 : 25); stipes 3.5 times as long as wide (13 : 48), posterior margin with long hairs, longest towards base (Fig. 1D); maxillary palp extending beyond tip of galea (Fig. 1D); apex of galea rounded with stout hairs on posterior margin, decreasing in length posteriorly (Fig. 1D); mandible slightly curved, bidentate (Fig. 1G); labrum (Fig. 1E) subtriangular, wider than long (21 : 12). Mesosoma: foreleg not attenuate, three-quarters length of body (Table 1); hind tibia as wide as basitarsus, tibial spurs finely serrated, hind basitarsus trapezoidal in shape with small shiny-brown scale-like projection on distal dorsal angle (Fig. 4B). Wings (Fig. 4A): forewing with second submarginal cell wider than long (28 : 19), receiving first recurrent vein at middle, third submarginal cell twice as wide as long (40 : 21), receiving second recurrent vein beyond middle (12 : 28), basal vein curved, 2.5 times length of the first abscissa of RS, meeting Cu at junction with Cu–V. Jugal lobe of hind wing less than half length of vannal lobe (36 : 81); 9–10 hamuli; median mesoscutal line extending three-quarters length of segment, lying in a shallow longitudinal depression; propodeal triangle small, apical two-thirds parallel-sided or expanded slightly at apex, surface finely coriaceous at base, rest of propodeal surface coriaceous.

TABLE 1

Rediviva albifasciata. Mean measurements (\pm S.D.) of body, foreleg, forewing and foreleg to body ratio of females and males (all localities), and head and eye measurements and length to width ratio of malar space of females and males (Springbok only).

	Females		Males	
	Mean \pm S.D.	Range	Mean \pm S.D.	Range
	(n = 30)		(n = 6)	
Foreleg (mm)	6.9 \pm 0.08	6.5–7.3	6.3 \pm 0.23	5.9–6.5
Body (mm)	9.0 \pm 0.16	8.2–10.3	8.2 \pm 0.85	6.9–8.5
Forewing (mm)	7.6 \pm 0.09	7.2–8.0	7.1 \pm 0.26	6.9–7.4
Foreleg/body	0.77 \pm 0.02	0.66–0.83	0.77 \pm 0.08	0.67–0.90
	(n = 10)		(n = 5)	
Head width (mm)	3.0 \pm 0.12	2.8–3.1	2.7 \pm 0.09	2.6–2.8
Head length (mm)	2.5 \pm 0.07	2.4–2.6	2.5 \pm 0.06	2.4–2.5
Interocular distance (mm)	2.0 \pm 0.07	1.9–2.1	1.8 \pm 0.10	1.2–1.9
Eye length (mm)	1.8 \pm 0.07	1.6–1.8	1.7 \pm 0.03	1.6–1.7
Malar space length/width	0.28 \pm 0.03	0.24–0.32	0.38 \pm 0.04	0.32–0.42

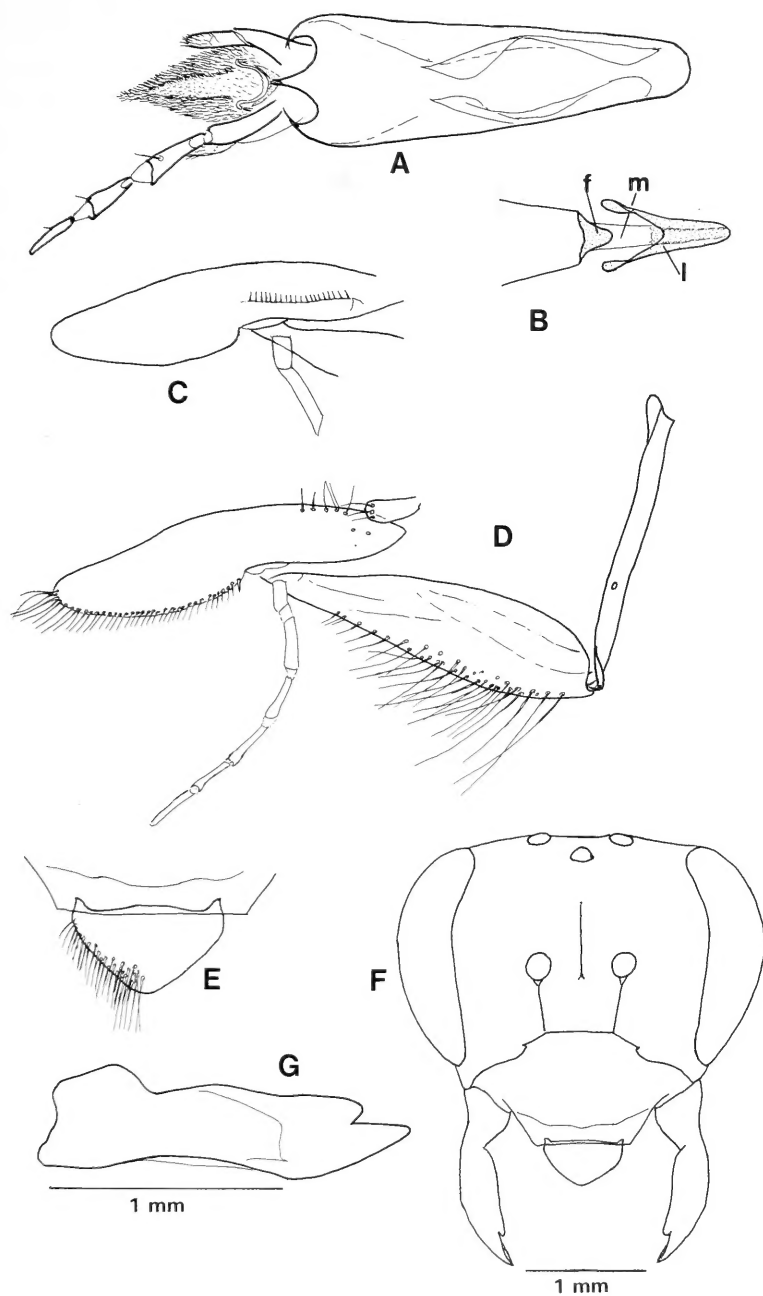


Fig. 1. *Rediviva albifasciata* sp. nov. Female, head and mouth-parts. A. Labium, posterior view. B. Anterior view of base of prementum with fragmentum (f), mentum (m) and lorum (l). C. Inner view of galea to show galeal comb. D. Outer view of maxilla. E. Labrum. F. Front view of head. G. Right mandible.

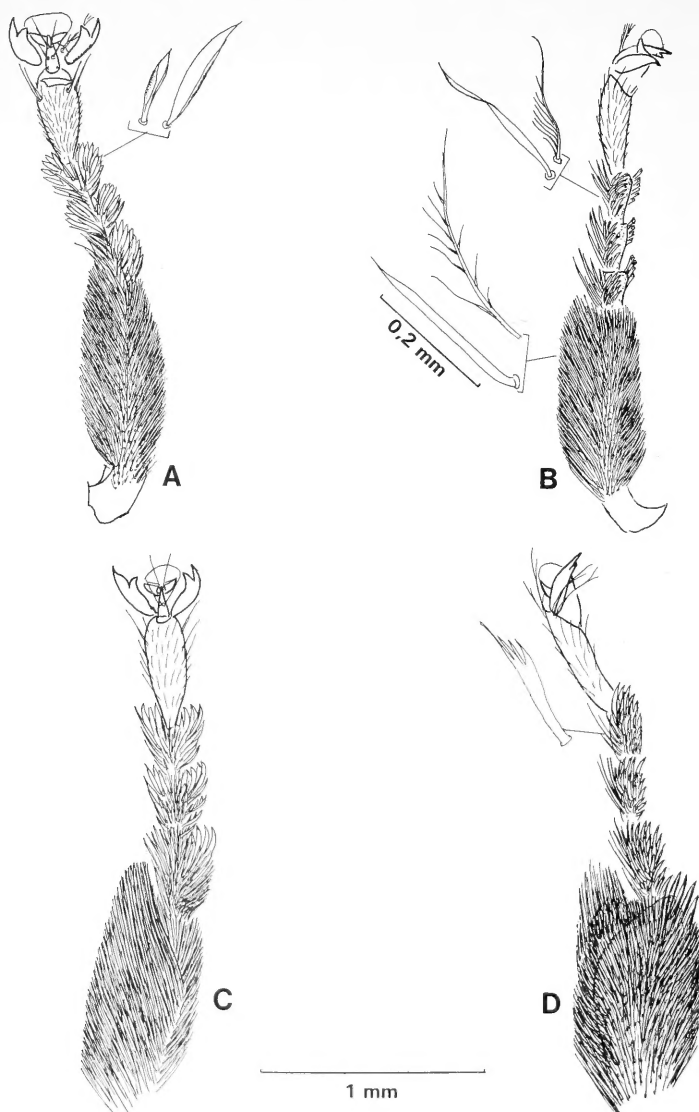


Fig. 2. *Rediviva albifasciata* sp. nov. Female. A. Tarsus of foreleg, dorsal view. B. Tarsus of foreleg, anterior view. C. Tarsus of middle leg, dorsal view. D. Tarsus of middle leg, anterior view.

Sculpture. Head: clypeus coarsely punctate, punctures sparser apically, area between punctures shiny; supraclypeal area coarsely punctured, surface between punctures roughened; coarse punctures on paraocular areas, becoming finer and coalescing towards vertex; frontal line extending from lower level of antennal sockets two-thirds distance to anterior ocellus (Fig. 1F). Mesosoma: scutum finely and densely punctate, punctures becoming finer and less dense in median

longitudinal depression, where surface between punctures is more shiny; disc of scutellum and metanotum finely and densely punctured. Metasoma: tergum T1 shiny with scattered fine punctures on apical quarter; T2–T4 with punctures becoming progressively coarser and denser on each segment, area between punctures shiny; T5 with areas between punctures finely variolate. Sterna with coarse punctation apically, surface between punctures shiny, basally impunctate or with scattered punctures, surface substrigulate.

Vestiture. Head: stout, light brown, unbranched hairs on anterior margin of labrum, mixture of white and black stout branched hairs on clypeus, finely branched pubescence on supraclypeal area, stronger hairs, more sparsely branched, on inner eye margins, black plumose hairs on vertex. Mesosoma: lateral areas of scutum, scutellum and all of metanotum with dense light brown pilosity, with some black hairs interspersed; fine decumbent light brown pubescence surrounding discal area of scutum and covering discal area of scutellum; propodeal triangle bare, rest of propodeum covered with light straw-coloured plumose hair; episternum and sternum with cream to white branched pilosity with similar pubescence on coxa, trochanter and femur of all legs; front and middle legs having anterior and posterior surfaces of tarsomeres II–IV densely covered with curved flattened scrapers (Fig. 2A), dorsal surface of tarsomeres II–IV of foreleg with mixture of straight stiff unbranched and finer branched hairs (Fig. 2B), corresponding dorsal surface of middle leg with straight stiff unbranched and broad flattened multi-tipped hairs (Fig. 2D); basitarsus of front and middle legs with mixture of strong unbranched and finer branched pubescence (Fig. 2D); anterior surface of hind tibia with strong, light brown, unbranched hairs protruding through underlying mat of finely branched hairs, pubescence becoming darker brown to black towards tibial plate, mat of finely branched hairs extending to narrow dorsal and distal edge of segment; posterior surface of hind tibia with strong light brown unbranched hairs without underlying mat of finely branched pubescence; anterior surface of hind basitarsus with strong light brown, unbranched pubescence, becoming darker towards distal area of segment where some branched hairs are present, dense underlying finely branched hairs also darkening towards distal edge of segment; stiff black unbranched hairs forming a penicillum on distal margin; posterior surface of hind basitarsus with strong unbranched light brown pubescence without underlying mat of fine pubescence. Metasoma: white hair bands on apical margin of T1–T4, short decumbent hairs on basal two-thirds of T2–T4, some longer suberect hairs on T4, fimbrium on T5 brown on disc, white laterally; long suberect brown hairs on anterior margins of sterna S2–S5.

Male

Measurement and ratios. Allotype male, body length 7.8 mm, forewing 6.8 mm, head width 2.7 mm, head length 2.3 mm, interocular distance 1.8 mm, eye length 1.6 mm, length of malar space one-third its width. Mean measurements of paratype males are given in Table 1.

Integumental colour. Body black, tip of mandible reddish-brown; dorsal surface of antenna black, ventral surface light brown; tegula and veins at base of wing light brown; tarsus of anterior and middle legs light brown, tibia and tarsus of hind leg brown.

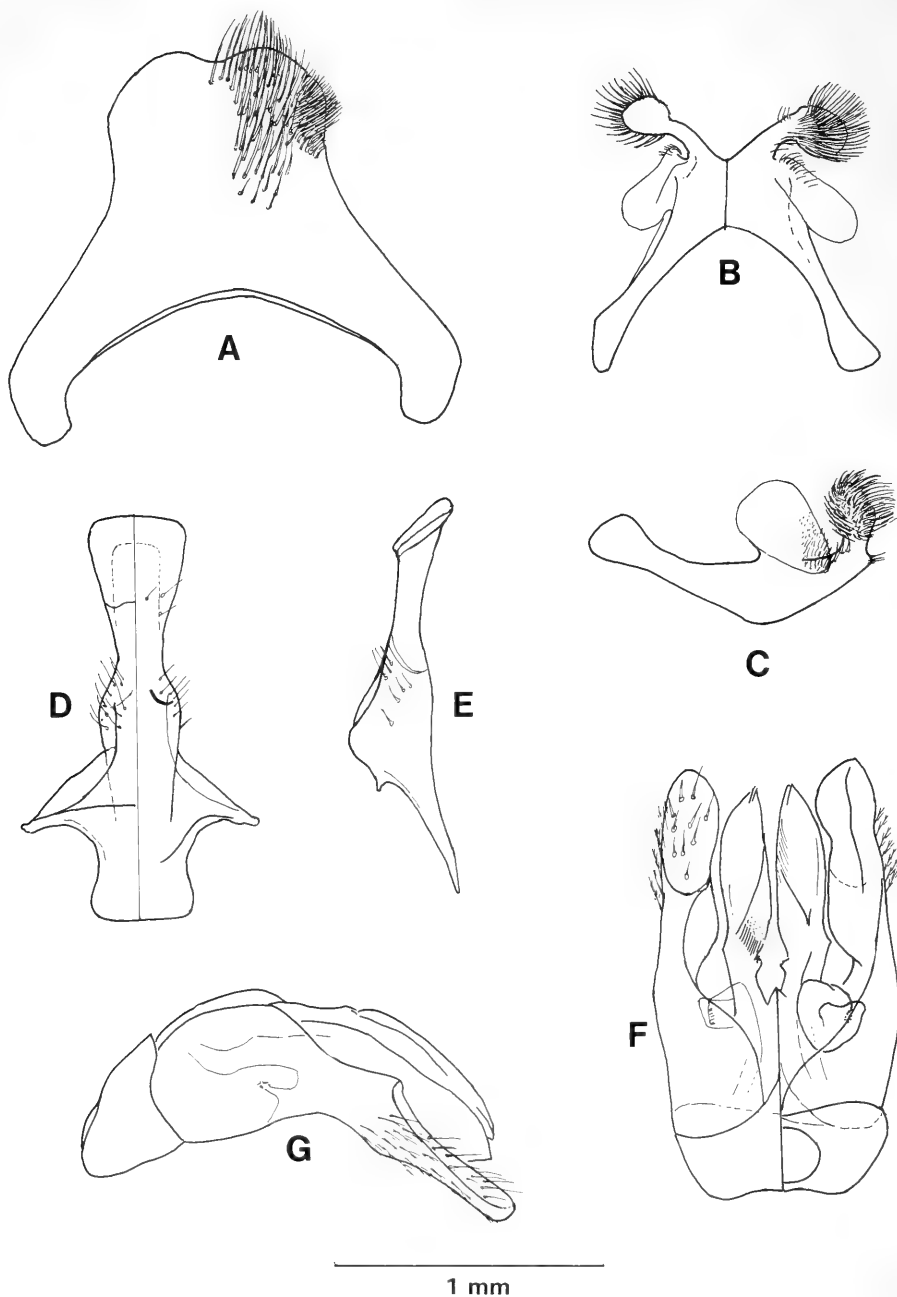


Fig. 3. *Rediviva albifasciata* sp. nov. Male, genitalia and terminal sterna. A. S6, ventral view. B. S7, dorsal (left) and ventral (right) view. C. S7, side view. D. Dorsal and ventral view of S8. E. S8, side view. F. Genital capsule, dorsal view (left) and ventral view (right). G. Genital capsule, side view.

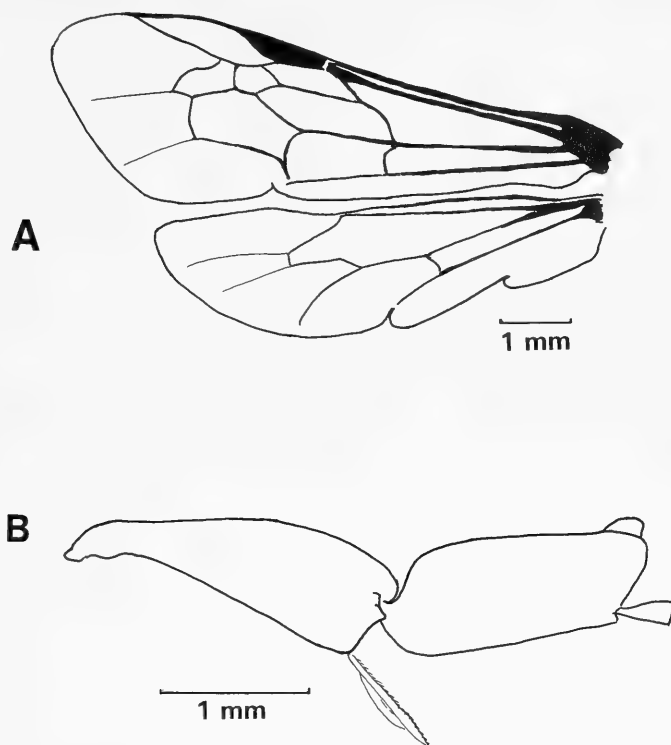


Fig. 4. *Rediviva albifasciata* sp. nov. A. Left wings of female.
B. Hind tibia and basitarsus of female (pubescence removed).

Structure. Head: inner distance between lateral ocelli greater than ocellular distance (29 : 21) and nearly five times distance of lateral ocellus from occipital ridge (29 : 6); first flagellar segment less than half length of scape (16 : 34), equal in length to flagellar segment 2, segment 2 shorter than flagellar segment 3 (15 : 18). Mesosoma: foreleg approximately three-quarters length of body, mean foreleg to body ratio not different from that of females (Table 1); small light brown spur at dorsal apex of tibia of middle leg; hind tibia slightly wider (at widest point) than basitarsus, spurs finely serrated, basitibial plate longer than broad, broadly pointed distally; jugal lobe of hind wing less than half length of vannal lobe. Metasoma: apical margins of S2–S5 straight, S6 with both apical and lateral lobes poorly developed (Fig. 3A), translucent area on disc, S7 with deeply emarginate apical margin and conspicuous apical lobes, lateral lobes large, oval, and translucent with papillae on proximal half (Fig. 3B–C), S8 (Fig. 3D–E) expanded slightly apically, apical margin entire; genitalia (Fig. 3F–G) with gonostylus fused to gonobase, extending a little beyond apex of penis valve, apical half dorsally flattened; volsella well developed with denticles on opposing surfaces of digitus and cuspis, opening posterolaterally.

Sculpture. Clypeus, paraocular and supraclypeal areas coarsely punctured, surface between punctures shiny, punctures becoming sparser towards vertex; scutum finely punctured, more coarsely punctured on scutellum and metanotum; punctuation on propodeal triangle and terga as in female; S6 with surface of basal half substrigulate, apical half coarsely punctured, area between punctures shiny.

Vestiture. Head: light brown unbranched hair on labium, rest of head covered in long silky, white plumose pubescence, with black hairs along inner margin of eye, epistomal suture and on vertex. Mesosoma: scutum, scutellum and metanotum with pale brown plumose hairs, some black hairs on disc of scutellum, rest of mesosoma covered in long white to pale straw-coloured plumose vestiture. Metasoma: S6 covered with pale branched straw-coloured hairs on most of segment but with tuft of short black hairs on lateral lobe; S7 with strong recurved branched hairs on outer face of anterior lobe (Fig. 3B-C); rest of pubescence as in female except fimbrium, which is pale straw-coloured.

Host flower records

Females collect oil and pollen from *Colpias mollis* E. Meyer ex Benth. and *Hemimeris racemosa* (Houtt.) Merrill (Scrophulariaceae) and nectar from *Oxalis pes-caprae* L., *Oxalis* sp. (Oxalidaceae) and *Cysticapnos vesicularis* (L.) Fedde (Fumariaceae). Males have been captured taking nectar from *Othonna arbuscula* (Thunb.) Schultz-Bip. (Asteraceae), *Oxalis pes-caprae* L. and *O. comosa* E. Meyer ex Sond. (Oxalidaceae). Males also patrol the two oil-producing plants presumably in search of receptive females.

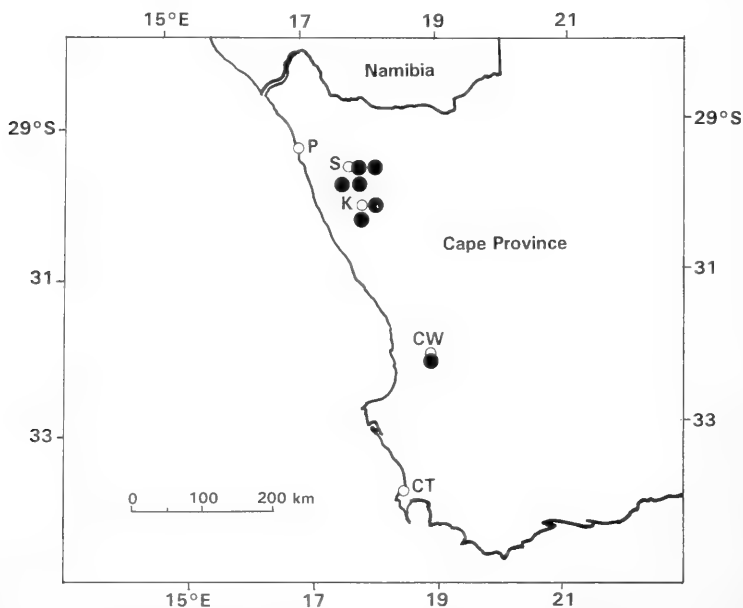


Fig. 5. Known distribution of *Rediviva albifasciata*. • = collection sites; ○: CT = Cape Town; CW = Clanwilliam; K = Kamieskroon; P = Port Nolloth; S = Springbok.

Distribution

Rediviva albifasciata occurs mainly in the mountainous regions of northern Namaqualand, but also has disjunct populations 300 km south in the Clanwilliam area (Fig. 5).

ACKNOWLEDGEMENTS

The Department of Nature and Environmental Conservation of the Cape Province is thanked for permission to work on the Goegap Reserve (formerly Hester Malan) at Springbok. The assistance of Senior Conservators J. (Kobus) Kritzinger and N. J. (Klaas) van Zyl, who were in charge of the above reserve during our period of research, is much appreciated. We are grateful to Dr Michael Struck of Botany Department, University of Cape Town, for the donation of several male specimens of the new species. We would also like to express our appreciation to the referees for their constructive comments and suggestions and for detection of some basic errors in the table.

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6. SYSTEMATIC papers must conform to the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family Nuculanidae

Nuculana (Lembulus) bicuspadata (Gould, 1845)

Figs 14–15A

Nucula (Leda) bicuspadata Gould, 1845: 37.

Leda plicifera A. Adams, 1856: 50.

Laeda bicuspadata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (fig. 8a–b).

Nucula largillierii Philippi, 1861: 87.

Leda bicuspadata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:

comma separates author's name and year

semicolon separates more than one reference by the same author

full stop separates references by different authors

figures of plates are enclosed in parentheses to distinguish them from text-figures

dash, not comma, separates consecutive numbers.

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

- The Figures, Maps and Tables of the paper when referred to in the text
e.g. '... the Figure depicting *C. namacolus* . . .': '... in *C. namacolus* (Fig. 10) . . .'
- The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
- Scientific names, but not their vernacular derivatives
e.g. Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should preferably be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as

'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively. The generic name should not be abbreviated at the beginning of a sentence or paragraph.

Name of new genus or species is not to be included in the title; it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.



V. B. WHITEHEAD

&

K. E. STEINER

A NEW *REDIVIVA* BEE
(HYMENOPTERA, MELITTIDAE)
FROM THE NORTH-WESTERN CAPE PROVINCE,
SOUTH AFRICA